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Neo-traditional approaches for ensuring food security in Fiji Islands

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ABSTRACT

The islands of Fiji are in a phase of transformation from polyculture to commercially oriented monoculture farming systems. The issue of food security has emerged as a major concern, exacerbated by vulnerability to climate change and natural disasters. A high dependence on imported processed food has resulted in problems of hidden hunger and non-communicable diseases. Traditionally, the diversity of landraces, wild food sources, food preservation practices, indigenous land preparation methods, *teitei* gardens and food tree species in agroforestry ensured food security. Colonialism, globalization, rural-urban migration, change in the structure of social organization and the lure of white collared jobs, have gradually eroded these Traditional Knowledge Systems (TKS). The commercial interests of the business and political elites have popularised a narrow spectrum of high yielding cash crops accelerating the pace of agrodeforestation. Current policies have an overbearing focus on conventional farming and marginalise the importance of traditional knowledge and nutritious diets. A neo-traditional approach to farming by the conservation of valuable landraces and community seed banks, promoting local food crops, organic farming and developing synergies between farming and the burgeoning tourism sector are key strategies which may revive the food security of the island people.

1. Introduction

The Small Island Developing States (SIDS) of the Pacific face, certain common but inherent economic and sustainable development challenges. These challenges are primarily attributable to their small size, remoteness, population rise, limited resource base, high vulnerability to climatic disasters and international market fluctuations (UN-OHRLLS, 2017). In spite of these limitations, the strength of the island states lies in the fact that more than 80% of the land and resources are owned by the community who are the collective custodians of the natural heritage (Ward, 2000). Customary governance systems such as temporary harvesting and access restrictions, seasonal bans and catch limits ensure the sustainable management of natural resources (Vukikomoala et al., 2012). Under such frameworks social developmental goals should score way above individual commercial interests, although it is pertinent to observe that not even the sentiments of community sharing and reciprocity are immune to the calls of land individualism and commodification. Another matter of pride for the people of the Pacific islands is the disposition that there is no such thing as unemployment in the conventional sense of the word since the people may choose to either fish or farm (Mak, 2012). The dependence on natural resources and the subsistence based livelihoods offer a typical contrast to the ideologies of the developed world possessed by the calls of modernisation and economic development. The transfer of technology, institutions and resources under the garb of economic development for the poor and underprivileged communities without the exploration and appreciation of their inherent traditional knowledge systems is the greatest paradox of recent times. As argued by Chambers (1983), the outside world has a very

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bigoted view of rural poverty which overlooks the wealth of indigenous knowledge and sustainable resource use.

The transition from predominantly agricultural to urban societies in the Pacific has resulted in the erosion of traditional and customary practices (Foraete, 2001). Post-colonial models of resource use rapidly replaced the indigenous practices of the people resulting in land degradation and inefficient resource management (King, 2004). In most of the post-colonial island societies the policies have been overly influenced and put in place by representatives of the British Empire and more recently by overseas experts (Blaikie and Brookfield, 2015). Most of the times these experts are relatively unaware of the endogenous practices of the island people and the traditional ways through which they have been utilizing scare resources sustainably. However, it is now being increasingly realised that developmental models in the third world countries will only succeed if indigenous knowledge is respected, recognised and accorded its rightful status in policy making (Brush and Stabinsky, 1996; Gegeo, 1998). In Indonesia traditional knowledge is responsible for higher agrobiodiversity and food security (David et al., 2012). Altieri (2003) raised his concern regarding the erosion of indigenous crop varieties and local food security in Latin America. In Africa the boycott of indigenous knowledge is a major cause of food insecurity (Kamwendo and Kamwendo, 2014) and it is argued that reviving traditional knowledge systems will go a long way in ensuring food security (Asogwa et al., 2017).

The islands of Fiji and the Pacific are facing problems of land degradation (Asafu-Adjaye, 2008; Blaikie and Brookfield, 2015) due to factors such as deforestation (UNCCCD, 2006), agrodeforestation (Clarke and Thaman, 1997), overgrazing (Asafu-Adjaye, 2008) and biological invasions (UNEP, 2002). Although Fiji has limited arable land, half is under sugarcane and coconut farming (FAO, 2008a), and a sizeable proportion has been taken over for residential, industrial and commercial developments (UNCCCD, 2006). Marginal land, including very steep areas, has been increasingly brought under farming particularly for cash crops such as sugarcane (Blaikie and Brookfield, 2015). The commercial interests of business and political elites have popularised cash crops highly vulnerable to international price fluctuations and market regulations while marginalising a plethora of indigenous food crops. There was a time when the people were self-sufficient with a sustainable production of traditional food crops rich in energy, nutrients and fibre. However, the call of modernity and urbanization compromised the nutritional and dietary well-being of the island people (Foraete, 2001). The high vulnerability to climate change and natural disasters further exacerbates food security concerns.

There has been a tremendous decline in the application of Traditional Knowledge Systems in food production along with a change from traditional diets to modern diets increasingly based on imported and processed food. The easy availability of processed food in supermarkets has resulted in rising incidences of Non-Communicable Diseases (NCDs) (Wate et al., 2013). Pacific islanders have among the highest incidences of obesity and diabetes in the world (Charlton et al., 2016) and 60–80% of deaths in the region are due to NCDs (Finucane et al., 2011). Diet transition and resultant surge in NCDs has also been reported from the Caribbean due to easy availability of cheaper low quality imported food (Government of Jamaica, 2013). In South Africa trade and investment liberalisation and consequent nutrition transition have been responsible for the NCDs epidemic (Thow et al., 2015). This paper evaluates the current status of food security in Fiji, role of TKS in food and nutritional security and transition from traditional farming to monoculture of cash crops. The authors argue that a neo-traditional approach to farming by the integration of traditional and modern food production systems is the way forward for a food secure country. Neo-traditional agriculture involves the enhancement of on farm diversity and security through conservation of locally adapted landraces for crop improvement and community seed banks, promotion of local food crops, organic farming and developing linkages between farms and the tourism industry.

2. Current status of food security in Fiji

The 1996 World Food Summit defined food security as the state “when all people at all times have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active, healthy life” (FAO, 1996). Four pillars of food security were recognised in this summit. The availability pillar ensures sufficient supply of local food supplemented by imports as and when needed, and the access pillar ensures access of households to food. The stability pillar ensures the resilience of food systems to external risks such as natural disasters, climate change, price fluctuations, conflicts or epidemics, while the utilisation pillar ensures provision of safe and nutritious food which meets dietary requirements. In the Pacific islands a fifth pillar has been identified which is the safety and nutrition pillar ensuring fresh or well preserved food contributing to a healthy diet (SPC, 2011). Smallness, remoteness and vulnerability have been identified as the three primary food factors exacerbating food security issues in small islands (Sharma, 2006).

2.1. Availability

An analysis of the availability pillar shows that although Fiji has a dietary energy supply adequacy above the global average (FAOSTAT, 2017), the country is grappling with problems of over nutrition and non-communicable diseases due to the consumption of energy dense processed food (Wate et al., 2013) easily available in the Fijian supermarkets. Around half of the dietary energy supply comes from cereals, roots and tubers (FAOSTAT, 2017). However, while around 34% energy is derived from cereals due to its low cost, only 20% comes from root crops (Schultz et al., 2007). The cultivation of a diversity of nutritious and resilient root crops has been overridden by taro hybrids for export with the result that local root crops are today more expensive than food from supermarkets (Foraete, 2001; Errington and Gewertz, 2008). Trade liberalisation and free market policies have jeopardised local food production resulting in closure of local dairy farms and declining rice farming with most of the population heavily dependent on cheap imported diets that are low in nutrition (Plahe et al., 2013). To maintain balance of payments policies promoting exports were put in place which gave an impetus to intensive production of cash crops while decreasing traditional crop production (Thaman and Clarke, 1983). Traditional food rich in fibre, complex carbohydrates and antioxidants is now reserved for special occasions while

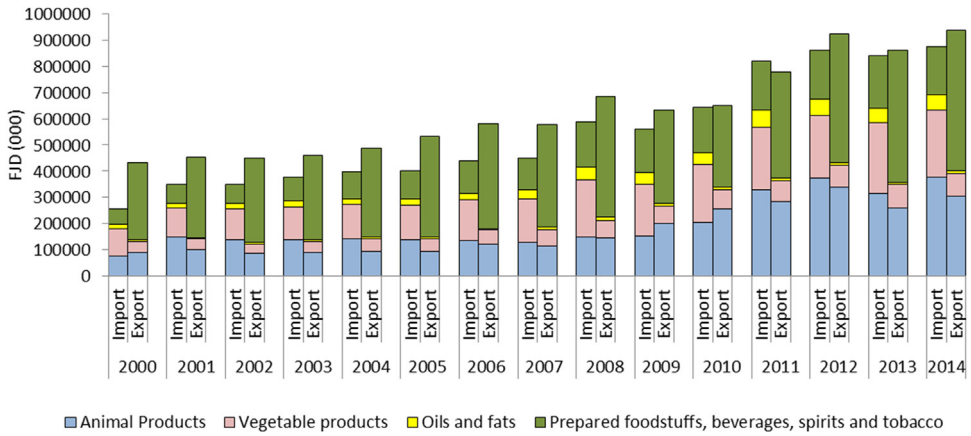

Fig. 1. Import versus export over 2000–2014.
Source: Fiji Bureau of Statistics.

calorie rich white rice, bread and tinned fish and/or meat of relatively low nutritional value are a daily affair (Lako, 2001; Wate et al., 2013). This is primarily due to the fact that growing traditional food is time consuming and labour intensive as opposed to the convenience of buying cheaper, ready to eat food from supermarkets (ADB, 2011). In Fiji 58% of calorie and 60% of protein needs are derived from nutritionally inferior imported food which is the highest in Melanesia (McGregor et al., 2009). The average supply of protein of animal origin is higher than the world average (FAOSTAT, 2017). However, there has been a decline in protein derived from sea and freshwater by 25% (Lako, 2001) since fresh fish is more expensive than tinned fish (Errington and Gewertz, 2008). The bulk of the protein is derived from tinned meat (Schultz, 2004). Mutton flaps which are fatty offcuts of low quality sheep meat unsalable in the global market were dumped by New Zealand in Fiji which imposed a ban on their import in 2000 but due to issues with enforcement, flaps have reappeared in local markets (UNDP, 2013).

2.2. Access

The Gross Domestic Product (GDP) per capita in purchasing power parity for Fiji is around 8657.8 which is below the global average of 14,697.6 (FAOSTAT, 2017). Low values of purchasing power parity indicate low economic access to food (Manap et al., 2015). This is one of the factors responsible for over dependence on cheap imported foodstuff. Fig. 1 shows the import and export of food commodities in Fiji over the period 2000–2014. Animal products include fish, lamb and dairy products, vegetable products include cereals and potatoes, oils and fats are of animal or vegetable origin, and prepared foodstuffs, beverages, spirits and tobacco includes, sugar, wine, alcohol and sweet biscuits.

2.3. Stability

Fiji has a very high cereal import dependency ratio at 99.8% (FAOSTAT, 2017). In 1986 Fiji was 75% self-sufficient in rice production (MPI, 2012). Agricultural deregulation began in 1987 with the withdrawal of support to domestic rice farmers and replacement of import licenses with low tariffs (Prasad, 1997). Gradually tariffs on white rice were reduced from 40% in 1990 to 15% in 2010 resulting in a marked increase in white rice importation (Ravuvu et al., 2017). Today in terms of the dietary patterns staple root crops have been replaced with cereals such as white rice, flour and flour based products because of their low prices (Lako, 2001; Mavoa and McCabe, 2008). Fiji is vulnerable to El Nino droughts which lowers the annual rainfall by 20–50% (Korovulavula, 2016) resulting in severe crop failures. Therefore, another important food security indicator is the total arable land equipped for irrigation which highlights vulnerability of food production systems to water stress and drought. While only 16% of the total geographical area in Fiji is arable (FAO, 2003), 2.4% of this arable land is equipped for irrigation in comparison to the world average of 23.2% (FAOSTAT, 2017). The Food Import Capacity Index (FICI) assesses the ratio of food imports over total merchandise exports and hence the ability of a country to pay for the food imports. FICI for Fiji increased from 19% to 26% over the period 1999–2013 which is much higher than the global average of 5 (FAOSTAT, 2017). This is attributed to the lifting of preferential prices for sugar by the European Union and hence decreasing export earnings highlighting the vulnerability of small islands to external economic shocks (McGregor et al., 2009). The per capita food production and supply variability stand at 15.4 (constant 2004–2006 thousand I$ per capita) and 16.7 kcal/capita/day much higher than the world average of 2.1 and 7.0 respectively (FAOSTAT, 2017). The high vulnerability of Fiji to extreme climatic events such as cyclones, floods and droughts is a prime factor responsible for the production and supply variations. The 1998 El Nino drought in Fiji caused extensive damage to sugarcane and livestock with losses to the tune of US$75 million and US$10 million respectively (ADB, 2011) and a 34% decline in coconut production (Benson, 1997). In 1993 cyclone Ami resulted in losses worth US$35 million to the agriculture sector (Mackenzie et al., 2005). The flooding of Wainibuka and Rewa rivers in 2004 destroyed around 50–70% of the crops (Government of Fiji Islands, 2004). Benson (1997) reported strong correlation between cyclones and droughts, and agricultural GDP in Fiji.

2.4. Utilisation

There has been a surge in NCDs such as obesity, diabetes, anaemia, micronutrient deficiencies and cardiovascular disorders in Fiji. This is due to a change from traditional diets rich in fibre, nutrients and complex carbohydrates to packaged and imported diets based on refined starch, sodium, sugar and oil (Lako, 2001; Curtis, 2004; Wate et al., 2013). With around 9.8% of obesity recorded in adult population in the year 1993 (Schultz et al., 2007), there has been a tremendous jump to 28.4% in Fiji over the triennium 2011–2013 (FAOSTAT, 2017). The prevalence of anaemia among women of reproductive age is also high at around 30.4% for the period 2014–2016 (FAOSTAT, 2017) and is chiefly attributable to iron deficient diets (Schultz et al., 2007). A recent study by Lin et al. (2016) found that the prevalence of type 2 diabetes mellitus among Fijians adults doubled from 7.7% in 1980 to 15.6% in 2011 due to increased consumption of introduced food and drinks rich in refined carbohydrates and sugars (Lako, 2001).

3. Traditional Knowledge Systems (TKS) in Fiji

Indigenous knowledge is the knowledge associated with a culturally distinct ethnic group who are the original and long standing inhabitants of a particular area (Heyd, 1995). Indigenous knowledge refers to the practices and knowhow of a particular ethnic group which evolved in time and enabled communities to survive natural calamities through centuries (ISDR, 2009). Such systems assisted the people in managing their resources wisely, adapting to external forces of change (Melchias, 2001; Nakashima et al., 2012) and developing sustainable solutions to overbearing problems. However, these undocumented systems of knowledge are fast eroding, unable to keep pace with development and the call for modernity. The erosion of traditional knowledge systems in Fiji is attributed to colonialism, globalization, rural-urban migration, change in the structure of social organization and the lure of white collared jobs (Ishii, 1992). There has been rapid rural-urban migration in Fiji which has played a key role in eroding customary practices (Ishii, 1992) and traditional farming activities (Gounder, 2005). A preference for cash cropping and less labour intensive crops have diverted the interest of farmers to modern agriculture which promises short term gains but covertly violates the principles of sustainable development. The traditional knowledge systems of Fiji are further elaborated under the following heads:

3.1. Traditional Fijian calendar

In Fiji *vanua* means not only land, but also the associated flora, fauna, rivers and mountains, and the social and cultural system, the stewardship of which is essential for solidarity and harmony with the environment and land is held sacred by the Fijian people (Ravuvu, 1983). *Vanua* includes the *yavu* or the house site, *qele ni teitei* (arable land), *veikau* (forest) and *lewe ni vanua* (people) (Ravuvu, 1983). God is known as *kalou* wherein *lou* refers to the time when the young yam leaves spread over the soil filling the farmer with a sense of gratitude for the creator who is the giver of all life on earth (Tuwere, 2002). Traditional food systems are interwoven in the social and cultural fabric of village life in Fiji and the Pacific. This intricate association between the land, its fruits and the people was responsible for the genesis of several traditional methods for resource use and sustainability (Ishii, 1992).

The indigenous Fijians (*itaukei*) developed a traditional calendar (Table 1) meticulously observing the incidences on land and in the sea. The traditional Fijian calendar runs from June to May and is based on the food sources available at different times of the year and the cultivation cycle of the traditional staple yam (Ishii, 1992). This calendar served as a guide for resource use among the indigenous Fijians. Yam cultivation is also a sign of the power of village chiefs reflected by the size of the yam garden and the labour force they command for cultivation (Nayacakalou, 1978). This traditional calendar reveals the intricate relationship between the indigenous Fijians and the environment. It also throws light on their keen powers of observation and their deep understanding of nature and natural events. The fact that the Fijian communities planned their fishing and farming activities guided by natural phenomenon also made a significant yet unsung contribution to efficient and sustainable resource use.

3.2. Diversity of landraces

The Pacific islands are one of the regions in the world where agriculture first began. Taro, yam, sugarcane, breadfruit, banana and plantain originated in Papua New Guinea, and thereafter diffused to the other islands in the Pacific (Tisdell, 2015) where gradually a number of varieties were developed according to the local environmental conditions. Traditional farming systems evolved through trial and error by indigenous communities over thousands of years resulting in agroecosystems which were not only genetically diverse but also resilient (Westmoreland, 1999). Cultivation of domestic and wild varieties concurrently in traditional farming systems allowed natural cross pollination between varieties resulting in the development of a unique set of landraces (Tisdell, 2014). Landraces are those folk, traditional or primitive varieties which have a high degree of tolerance to biotic and abiotic stress and relatively intermediate but stable yields (Cleveland et al., 1994; Zeven, 1998). Landraces have evolved and adapted to the local environmental conditions in their specific place of origin (Lopes et al., 2015). A majority of the landraces outperform conventional varieties in terms of resistance to adverse factors such as insects, pests, weeds and diseases, and also have notably higher drought and flood tolerance. Traditional crop varieties are important for climate adaptation in the Karst mountains SW China, Coastal Kenya and the Bolivian Andes (Swiderska et al., 2011). Chivenge et al. (2015) argue that neglected and underutilised crop species (NUCS) knowledge systems contribute to food security in Sub-Saharan Africa.

Historically Pacific islanders used specific landraces of coconuts for specific purposes such as food, beverage, rope making, housing and medicine, but with the large scale establishment of coconut plantations the genetic diversity narrowed down to a few hybrids. It is alarming to observe that around half of the coconut landraces developed by the traditional farmers in the Pacific have

Table 1
Traditional Fijian Calendar.
Source: Adapted from Williams (1982), Seemann (1882).

Fijain (*itaukei*)	Month	Indicators		Activity
		Marine indicators	**Plant indicators**	
Vula i werewere	June/July	Silver biddy or matu (*Gerres* spp.) and goldspot herring or daniva (*Herklotsichthys quadrimaculatus*) are abundant in the sea in the month of June. In July octopus or kuita (*Octopus* spp.) and marbled cod or kerakera (*Epinepheius microdon*) are plentiful.	June is when the fruits of kavikas (*Syzygium malaccense*), wi (*Spondias dulcis*), dawa (*Pometia pinnata*) ripen.	Clearing the land for planting yams. Kawai (*Dioscorea aculeata*) and Kaile (*Dioscorea bulbifera*) both wild yams are dug up in the forests.
Vula i cukicuki	July/August	Octopus are abundant in the sea	Blooming of the Ivi or Tahitian Chesnut (*Inocarpus fagifer*) tree.	Ploughing the land for planting yam.
Vula i vavakadi	September	Rock cod or kawakawa (*Anyperodon leucogrammicus*) spawn in the sea.		Young yam plants are tied to sticks for support. Planting yams, kawai and kumara or sweet potato.
Vula i balolo lailai	October	Annual rising or spawning of the *Eunice viridus*, an edible reefworm balolo in small numbers	Kaile, kavikas and breadfruit abundant on land. Ivi or Tahitian Chesnut (*Inocarpus fagifer*) in bloom.	Kawai planting continues.
Vula i balolo levu	November	Annual rising or spawning of the *Eunice viridus*, an edible reefworm balolo in large numbers	Bananas in abundance.	Tivoli (*Dioscorea nummularia*) a wild yam ready for digging.
Vula i nuqa lailai	December	Nuqa (*Siganus vermiculatus*) fish appear in small numbers	Wi fruit ripens.	Banana and breadfruit planted.
Vula i nuqa levu	January	Nuqa (*Siganus vermiculatus*) fish and land crabs or lairo (*Cardisoma carnifex*) abundant.	Damanu trees flowers. Fruits of Ivi, wi and breadfruit start appearing.	A few early yams are dug up.
Vula i Sevu	February		Ivi and wi trees bear abundant fruits.	First fruits of the season (yams) are offered to the priest and village chief in a ceremony called sevu.
Vula i Kelikeli	March	Green mangrove crabs or qari (*Scylla paramamosain*) mature.	The Ivi tree puts out new leaves.	Digging of yams, building of yam houses (lololo) and storage. Turtle fishing.
Vula i Gasau	April	Bigeye scad or tuqadra (*Selar crumenophthalmus*) is abundant.	Breadfruit ripens. Reeds or gasau (*Miscanthus floridulus*) begin to sprout.	Gasau used for house building. Turtle fishing.
Vula i Doi	May	Chub mackerel or salala (*Rastrelliger brachysoma*) abundant.	Flowering of the doi (*Alphitonia zizyphoides*) tree	Early varieties of yams are set.

already been lost due to the massive propagation of the copra producing varieties in the colonial plantations (Bourdeix et al., 2016). FAO (2008a) estimated that around 75% of the agrobiodiversity in the world has been lost in the twentieth century due to the replacement of traditional varieties by conventional varieties. The call of the modernisation and commercialisation of food and farming systems driven by the sole objective of generating high yields is the single most important threat to agrobiodiversity (Dwivedi et al., 2016). In Fiji a narrow genetic spectrum of cash crops which includes cassava, taro, sugarcane and kava (mild narcotic drink) are being intensively cultivated in monoculture systems supplemented with the application of fertilizers, pesticides and insecticides. The promotion of these intensive plantations of cash crops has been responsible for the loss of folk varieties of traditional food crops and trees such as breadfruit, plantain and banana (Thaman, 2008).

Pacific islands have unique indigenous banana diversity particularly the *fei*, *maoli*, *popoulu* and *iholena* varieties all of which are highly nutritious but grossly underutilized (Kagy et al., 2016). Recently Kagy et al. (2016) reported the erosion of banana diversity in the Pacific due to the loss of their cultural and magical significance. Another food tree breadfruit, a traditional Pacific staple, has tremendous potential to solve problems of food insecurity due to yields per hectare way higher than conventional cereals. Breadfruit flour is also nutritionally superior to cereal flours and can be used in infant formulas and extruded products (Jones et al., 2011). Around 70 landraces of breadfruit are reported in Fiji (Ragone, 1997) with different cultivars having different seasonality thereby ensuring food supply for extended periods (Thaman, 1990). Agrodeforestation has however resulted in the loss of traditional varieties and a decline in breadfruit cultivation. Fiji is very rich in terms of the genetic diversity of taro where 72 landraces (Taylor et al., 2010) were once cultivated by the traditional farmers. However, with the commercialisation of taro farming the government started supporting early maturing, high yielding and relatively tolerant hybrid varieties. Today traditional taro cultivars are no longer sold in the local markets which are flooded with the export varieties (FAO, 2008b) with most farmers raising only two hybrids the *Tausala ni Samoa* and *Tausala* (Samoa hybrid) (Lin, 2016) and a third variety the Rewa hybrid gradually becoming popular (Table 2).

3.3. Traditional Knowledge Systems (TKS) and food security

Traditional farming methods were essentially polycultural systems which employed practices like mixed cropping, and acted as natural germplasm conservatories for plants of ethobotanical signifiance (Kumar, 2013) and valuable landraces (Cleveland et al., 1994). Thaman et al. (2000) have observed that it was due to the traditional agroforestry systems that the people of the Pacific Islands were the most self-sufficient and well-nourished in the world. Foraete (2001) described traditional food as the hidden strength of the Fijian economy. William Clarke (1977) while studying the *Bomagai Angoiang* agro ecosystem in Papua New Guniea argues that traditional farming systems are “structures of permanence”. He described these agro ecosystems as requiring no external inputs of seeds, nutrients and energy, non-self-poisoning, reaping positive energy yields, human bound time scale, equitable resource distribution, resource preservation for future generations, and diversity and polyculture; all tenets of efficient resource use.

3.3.1. Traditional Knowledge Systems (TKS) and climate resilience

Since islands are particularly vulnerable to cyclones and climatic extremes, TKS ensures food security during such exigencies. Some of the indigenous mechanisms of food security and self-sufficiency were: polyculture and sequential farming, soil conservation techniques and composting, traditional food preservation methods, gathering food from forests and the cultivation of traditional food crops with a long shelf life (Simatupang and Fleming, 2000). Historically communities in Fiji cultivated giant swamp taro (*Cyrtosperma chamissonis*) and giant taro (*Alocasia macrorrhiza*). The giant swamp taro can stay for upto 30 years in the ground (Englberger et al., 2008) and is tolerant to water logging and saline conditions (Rao, 2011). Giant taro is resistant to the Papuan beetle and tolerant to drought and water logging (Mael, 2013). Yams (*Dioscorea alata*) once the staple food for many indigenous communities in Fiji, have a long shelf life and act as a food reserve during unfavourable periods. In *Tokaimalo*, Ra province of western Viti Levu (Fiji), yam was cultivated along river banks but this tradition has been dying over the years (Ishii, 1992) owing to rural-urban migration. In Kadavu the tradition of planting and storing yams for food security has been replaced with the cultivation of remunerative crops like dalo and kava (Foraete, 2001). Other climate resilient traditional crops of the Fijians include *dalo ni tana* (*Xanthosoma sagittifolium*), *tivoli* or Pacific wild yam (*Dioscorea nummularia*) and kumala or sweet potato (*Ipomoea batatas*) all of which are drought tolerant (Korovulavula, 2016) and can play a vital role in ensuring food security during dry spells. Several local varieties of dalo such as *uro ni vonu*, *vavai dina* and *vaivai loa* are also resistant to water logging (Ministry of Agriculture, 2006).

Prior to deregulation farmers grew traditional rice varieties in 80% of the rainfed wetland areas because of their tolerance to drought and water logging. Farmers planted improved varieties for sale but reserved small plots of traditional varieties for household consumption. Traditional varieties like *Rewa Patna, China Patna, Motmuria, Sareya Patna, Golka* and New Guinea have been out of cultivation for long (Bong, 2017). Clarke and Thaman (1993) have reported a tremendous decline in the cultivation of traditional crops ever since the introduction of crops like cassava which are less labour intensive and require shorter fallow periods (Thaman and Thomas, 1985). There were lessons to be learnt when Tropical Cyclone Meli struck Fiji in 1979. Traditional crops like yams, kumala and giant taro were more resilient to wind damage than crops such as cassava while *voivoi* (*Pandanus* spp.) was the most resilient among trees (Campbell, 2006).

3.3.2. Wild food sources

The dependence on wild food sources such as wild yams, Tahitian chesnut, edible ferns or ota (*Diplazium esculentum)*, mangrove ferns such as boreti (*Acrosticum areum*) and sago palm (*Metroxylon vitiensis*) (Thaman, 1990) which were collected from the wild if in case the primary crops failed was a major contributor to food security. However, today deforestation particularly for cultivation of cash crops has brought about a significant decline in the population of these famine foods once abundant in tropical rainforests

Table 2
Landraces and/or local cultivars of some important traditional crops with Melanesia as the centre of origin.

Crop	Scientific name	Country of origin	Number of landraces and/or local cultivars	Reported occurrence	Reference
Breadfruit	*Artocarpus altilis*	Papua New Guinea (Roberts-Nkrumah, 2015)	70, 133	Fiji, Pohnpei (FSM)	Ragone (1997), Raynor (1991) cited in Englberger et al. (2009)
Taro	*Colocassia esculenta*	Papua New Guinea (Fullagar et al., 2006)	72	Fiji	Taylor et al. (2010)
Kava	*Piper methysticum*	Northern Vanuatu (Kate and Laird, 1999)	82	Vanuatu	Lebot and Simeoni (2004)
Banana and plantains	*Musa* spp.	Papua New Guinea (Denham et al., 2003)	55	Pohnpei (FSM)	Raynor, 1991 cited in Englberger et al. (2009)
Yam	*Dioscorea* spp.	Papua New Guinea (Fullagar et al., 2006)	177	Pohnpei (FSM)	Raynor et al. (1992)
Coconut	*Cocos nucifera*	Melanesia (Child, 1974)	87	Vanuatu	Osborne (2005)

Note: Pohnpei is one of the four states in the Federated States of Micronesia (FSM).

(Jansen et al., 1990). While unsustainable extraction from the wild pushed the edible ferns deeper and deeper into the forests, the habitat for wild yams declined due to land clearing for cash crops (McGregor and McGregor, 1999). Sago palm has become endangered due to overexploitation by the tourism industry where the fronds are used for thatching bures and over harvesting by local communities for food (Morrison et al., 2012).

3.3.3. Storage and food preservation

Asogwa et al. (2017) opined that indigenous food preservation methods are an important source of food security in Africa. Traditional storage and preservation techniques have also contributed to food security in Uganda (Nelson, 2015). The food preservation processes employed by the indigenous Fijians have ensured sufficient food stocks in the wake of natural disasters (SPC, 2016). Among the long term methods of food preservation were the field storage of root crops by leaving them as such in the ground for long periods of time (Campbell, 2006). Fermentation was recognised as a unique traditional technique of food preservation (Pollock, 1992). *Davuke* or the pit preservation process was used for preservation of staple carbohydrate food such as taro and breadfruit. Food was soaked in water, buried in leaf lined pits and allowed to ferment (Aalbersberg et al., 1988). Another popular method of food storage was sun drying the food either whole or as shavings of root crops (Schultz et al., 2009). Yams were stored either in yam houses (*lololo*) (Ishii, 1992) or in heaps covered with soil and banana leaves (Parkinson, 1984). Short term preservation methods included submersion of root crops and breadfruit in fresh water which inhibited the rate of respiration and prolonged food storage (Parkinson, 1984). Cooking in earth ovens and in sections of bamboo were other methods for preserving food over the short term (Morrison et al., 1994). Traditional ovens (*lovo*) were prepared by digging a pit, heating stones on burning logs, wrapping the food in banana leaves and covering the pit with earth (Jansen et al., 1990). Fruits such as plantain were either soaked in salt water prior to baking in stone ovens or baked first and thereafter buried in earth. Another traditional method of food preservation was cooking food over hot embers in sections of bamboo the ends of which are sealed with leaves of banana, once a common practice in Fiji but now a lost art (Parkinson, 1984).

3.3.4. Consumption patterns and food security

In Fiji *kakana dina* or true food refers to traditional starch rich food crops like yams, taro, sweet potato, plantain and breadfruit (Ravuvu, 1991). Although Fiji is undergoing dietary changes however, traditional food is an inalienable aspect of the food culture of the local community. Reviving traditional food crops can go a long way in ensuring food security. While an increase in monocropping reduces the diversity of food crops in local markets, a shortage of healthy locally produced food results in poor dietary choices and nutritional deficiencies (Kaiser, 2011). The increased production and availability of local food reduces dependence on processed foodstuff. Good local availability of fruits and vegetables in markets improves dietary patterns (Kamphuis et al., 2006).

3.4. Traditional land preparation methods

Traditional land management systems incorporated practices such as long fallows, crop rotation, composting and mulching in swampy low lying islands and atolls, terracing along contours and land rotation on highlands. Such practices maintained soil fertility and minimised soil erosion (Morrison and Clarke, 1990; King, 2004). Indigenous farmers practiced two forms of taro farming – dryland and wetland and developed two methods for cultivating such varieties; raised beds and irrigated terraces.

3.4.1. Raised beds

Raised beds designed for wetland taro farming in poorly drained lowlands are locally known as *vuci, solove,* or *vuevue* (Kuhlken and Crosby, 1999). These beds were once widespread in the coastal, riparian and swampy areas of Fiji particularly the Rewa river delta, where they once extended over 5200 ha (Parry, 1979) and interestingly people from this region were called the via eaters (Parry, 1994). Seemann (1862) observed three varieties cultivated by the Fijians in the Rewa swamps; *Alocasia indica* (*via mila*), *Cyrtosperma edulis* (*via kana*) and *Amorphophallus campanulatus* (*daiga*). Raised beds are compost pits where soil is dug and then raised to drain away the excess water followed by mulching. In the traditional via gardens farmers practiced agroforestry by planting via in the ponds and plantain and yams in the raised bund (Parry, 1994).

Compost pits of the giant swamp taro were popular forms of permanent cultivation particularly in Micronesia (Thompson, 1982) and to a lesser extent in Polynesia and Melanesia. It was once extensively cultivated in the delta of the Rewa in Viti Levu (Clarke et al., 1999), Rotuma and Rabi islands in Fiji (Jansen et al., 1990). This species is particularly suitable for low lying islands and atolls where soils are swampy, shallow and relatively unproductive (Plucknett, 1977). It also served as a food reserve during emergencies when no other food sources were available because of its ability to remain in the soil almost indefinitely. Pits excavated right down to the ground water lens were filled with a mixture of soil, sand, and plant and animal manure where various cultivars of taro were raised (Plucknett, 1977; Clarke et al., 1999). Coconut, breadfruit, pandanus and arrowroot surrounded the pits in a typical agroforestry system (Hather and Weisler, 2000). However, there has been a tremendous decline in pit cultivation of swamp taro due to a preference for imported food in Marshall Islands (FAO, 2008b), ground water salinization as a result of climate change coupled with a change of food preference and lifestyles in Tuvalu (Rao, 2011) and as observed in a number of Pacific atolls the introduction of copra plantations (Farrell, 1972).

3.4.2. Irrigated terraces

Irrigated terrace system was first developed in Fiji around 1100 A.D (Kirch, 2000). Traditional irrigated terraces locally known as *tabaiwai, waisa, laua* (Jansen et al., 1990), *wanu* or *waitaki* (Kuhlken, 1994), were used by those farmers in the highlands who could

not farm taro in natural swamps. This form of traditional taro farming was extensively practiced in the catchments of Nakauvadra, Sigatoka and Ba in Viti Levu, Taveuni, Kadavu, Gau and parts of Vanua Levu (Kuhlken, 1994). Nakauvadra has the remnants of the largest irrigated terrace gardens in Fiji covering around 325 ha (Frazer, 1961) and represents a unique example of "true irrigation" as Spriggs (1984) calls it. Farmers were well aware that a good taro crop would require wet but well aerated fertile alluvial soil. So they developed a traditional method of diverting the water from streams and creeks into a series of terraces over which the water would slowly but steadily trickle down (Spencer and Hale, 1961).

There were two types of terraces designed by the indigenous farmers: hillside terraces with earthen embankments built along contours and streamside terraces along springs or minor creeks. It is pertinent to observe that farmers also practiced land rotation and moved on to another site to build the terraces thereby allowing the soil to recover its fertility. In the island of Kadavu in Fiji, farmers alternated dryland and wetland farming of taro with a fallow period over a four year cycle. Planting material of the dryland taro (raised beds) was used for the propagation of the wetland taro (irrigated terraces) and vice versa as the Fijians believed that this improved the quality of the planting material (Kuhlken and Crosby, 1999). According to King (2004), these terraces may have also assisted in soil conservation in sloping areas. Kuhlken (1994) reported that Gau and Kadavu on account of their relative geographic isolation are among the only islands in Fiji where the terrace farming of taro is still practised on a small scale, whereas for the rest of Fiji they are but historical relicts whose remains can still be seen in the abandoned landscape.

3.5. Teitei gardens

Teitei are the traditional food gardens of the Fijian people where they raise a diversity of plants. Traditionally every household has a *teitei* which is handed over from one generation to the next (Erasaari, 2013). The *teitei* gardens are greatly influenced by *mataqali* ownership of land and the delineations though not on paper are strictly adhered to. The fertile land within the villages are reserved for the *teitei* of the village elders while the youngsters establish their gardens in forests, on steep slopes and on sites further away from the village. This results in a young farmer tending to food gardens in different plots in several different places. The people may construct a farmhouse (*vale ni teitei*) near the *teitei* during intensive farming seasons (Erasaari, 2013).

Within the *teitei* are raised plants of tremendous ethnobotanical importance ranging from those for food to medicinal, spiritual and cultural purposes. Food for the household and for rituals and ceremonies, kava for community gatherings, medicinal plants for treating ailments, dyes for painting, fronds for thatching, timber for light construction and fencing, are all obtained from the *teitei* gardens. Lin (2016) refers to the *teitei* gardens, as hidden diversity where the people still retain plants of ethnobotanical significance often overshadowed by the more prominent cash crops such as kava and commercial taro hybrids. An important characteristic of such traditional food gardens is the high degree of agro biodiversity (Altieri, 2003) which ensures security against pests, diseases, drought and other environmental stresses thereby contributing to food and nutritional security.

3.6. Traditional food tree species in agroforestry

The subsistence based polycultural agroecosystems of the Pacific act as repositories of in situ agrobiodiversity conservation. This is possible through the on-farm cultivation, conservation and sustainable management of a diversity of plant populations and traditional varieties within the agroecosystems where the plants have evolved (Bellon et al., 1997). Historically when clearing patches of forests for establishing food gardens, it was a common practice to retain culturally and ecologically significant trees, and further enrich the agroforests by the deliberate introduction of a variety of multipurpose trees. This played a vital role in ensuring food security during climatic exigencies and nutritional well-being of the local communities. Today agrodeforestation has resulted in the replacement of food trees in Fiji's farming systems by cash crops. Home gardens and farming systems in Fiji have less number of trees and a variety of trees of ethnobotanical significance are no longer raised by farmers (Clarke and Thaman, 1993). Some of the traditional fruit and nut trees in agroforestry include *Spondias dulcis* (*amra*), *Syzygium malaccense* (*kavika*), *Pometia pinnata* (*dawa*), *Inocarpus fagifer* (*ivi*), *Barringtonia edulis* (*vutu*) and *Terminalia catappa* (*tavola*) (Table 3).

4. Transition from traditional to commercial farming systems

In response to the call for transition to cash based economies by the colonial governments large scale plantations of crops such as coconut, coffee, cocoa, rubber, oil palm were promoted (Clarke and Thaman, 1993). Subsistence farmers who practised traditional methods evolved into commercial farmers who raised cash crops. The changes in land tenure system in Fiji favoured commercial agriculture as opposed to traditional farming (Ward, 1982). Around 83% of the land in Fiji is under customary ownership (Whiteman, 2005) and can be leased for upto 99 years with most of the leases currently in agriculture and forestry. Kumar (2013) reported that in the lower Naitasiri subsistence farming is mainly practiced by the *itaukei* on the native or mataqali land whereas the *Indo-Fijian* community is more likely to practice commercial farming on the leased land.

The transition to cash based economies affected traditional farming systems in several ways. Within villages' cash crops and cattle pastures replaced traditional food gardens which were displaced to areas further away making it difficult for people to tend to their gardens. Cash crops were planted in fertile lands while traditional farming shifted to inferior plots (Ward, 1982; Ravuvu, 1988; Jansen et al., 1990). The net result was that yields from traditional farming and food crops declined while the dependence on cash for survival increased. Therefore, self-sufficiency gave way to commercialisation (Ward, 1982; Pollock, 2004) and the vicious cycle of the monetisation of biological resources gradually became a way of life for the island people.

Table 3
Traditional tree species in Fiji important for their food value.

Category	Tree species	Local name	Major uses	References
Main food	*Artocarpus altilis*	Breadfruit, uto, uto sori. kulu, buco, buco ni viti	Edible fruit	Clarke and Thaman (1993)
Food supplement	*Citrus hystrix*	moli karokaro, soco ni Vavalagi	Edible fruit	Jansen et al. (1990)
	Veitchia joannis	Niusawa, saqiwa	Edible seeds and palm heart	Johnson (1998)
	V. vitiensis	Sakiki	Palm heart, seed and inflorescence edible	Johnson (1998)
	Metroxylon vitiense	Sage palm, sago, soya, soga	Edible palm heart	Morrison et al. (2012); Smith (2015)
	Pritchardia pacifica	Fiji Fan Palm, masei, sakiki	Edible seeds	Johnson (1998)
Condiments	*Cordyline fruticosa*	Ti, vasili, vakota	Roots yield a sweetener	Jansen et al. (1990); Clarke and Thaman (1993)
Fruit	*Spondias dulcis*	Tahitian vi apple, Wi, amra,	Edible fruit, pickles	Lin (2016)
	Syzygium malaccense	Malay apple, kavika	Edible fruit	Lin (2016)
	Pometia pinnata	Oceanic lychee, dawa, dawa moli, dawa sere, dawadawa, tavisivesi,	Edible fruit	Lin (2016)
	Annona muricata	Soursop, seremaia	Fruit is edible	Thaman (1988)
	Ficus vitiensis	Lolo	Edible fruit	Clarke and Thaman (1993)
Nut	*Inocarpus fagifer*	Tahitian chestnut, ivi	Edible nut	Clarke and Thaman (1993); Lin (2016)
	Barringtonia edulis	Cutnut, vutu, vutu valu, vutu kana	Edible nut	Cambie and Ash (1994); Kumar (2013)
	Terminalia catappa	Tropical almond, tavola	Edible nut	Thomson and Evans (2006)
Drinks	*Cocos nucifera*	Coconut, niu, niudamu, niu dina	Beverage	WHO (1998)
	Morinda citrifolia	Indian mulberry, kura, noni, nono, kikiri	Health tonic	Cambie and Ash (1994); Nelson (2006)
Leafy vegetable	*Gnetum gnemon*	Sukau, sukau buli, sukau motu	Leaves yield a spinach like green vegetable	Jansen et al. (1990)

4.1. Cotton plantations in the 1860s

The disruption of cotton supplies during the American Civil War in the early eighteen sixties (Townsend, 2005) drastically increased cotton prices in Europe and so cotton plantations were established in Fiji (Stokes, 1968). A highly priced sea island variety of cotton was introduced which gradually almost exclusively replaced the hardier kidney cotton variety. Cotton growing soon encountered several issues: the small size of plantations, huge expenditures, living on credit, uncertain returns, labour scarcity, coinciding of the heaviest cotton production season with the wet season, frequent incidences of natural disasters (Forbes, 1875) and lack of adequate knowledge of cotton growing in tropical islands (Stokes, 1968). In 1870 cotton prices in London dropped drastically in response to the shutdown of French textile industries during the Franco-Prussian War. By this time the American cotton had also reappeared in European markets and the Fijian cotton planters, left in heavy debt soon switched to other crops (Stokes, 1968).

4.2. Sugarcane plantations in the 1870s

The earliest sugarcane plantations in Viti Levu failed since they were established towards the wetter eastern zone by planters who mistook the lushness of the landscape as a sign of fertility (FAO, 1997) with the first small scale sugar mill set up in Suva in 1872. When the British colonised Fiji, they established plantations of sugarcane in western Viti Levu with indentured labour brought from India on five year contracts. An Australian firm the Colonial Sugar Refining Company (CSR) started operations in Fiji in 1882 and exclusively bought almost all the cane grown by the smallholder farmers until the year 1973 when the Fiji Sugar Corporation (FSC) came into operation. When the contracts of the Indians expired they started leasing land from the Fijians for cane production (Moynagh, 1981) and today most of the sugarcane farmers are the *Indo-Fijian* communities.

The sugarcane plantations however face several issues such as the nonrenewal of land leases, removal of the preferential European Union export sugar prices (Narayan and Prasad, 2003), vulnerability to natural disasters, inadequate infrastructure and declining mill efficiency, rising cost of production due to high input costs (Fiji National Agricultural Census, 2009) and intensive mono cropping resulting in declining soil fertility (Naicker, 2012). An increase in pre harvesting cane burning to facilitate rapid harvesting, minimise labour requirements, increase crop weight and seek milling priority (King, 2001), has accelerated soil degradation (Davies, 1998). Commercial sugar cane farming in Fiji also had a major role to play in the displacement of traditional crops (Tisdell, 2014). A comparison of the 1991 and 2009 census reveals that the contribution of the sugar industry to the GDP of Fiji declined from 22% in 1991 to 9.5% in 2009 and the cane production fell from 3,380,000 t in 1991 to 2,197,950 t in 2009 (Fiji National Agricultural Census, 2009).

4.3. Coconut plantations of the 1890s

Large scale coconut plantations were established in the 1870s in Cakaudrove and Taveuni (Duncan and Sing, 2009). By 1880 Eastern Fiji became a major export base of copra (Bayliss-Smith et al., 1998). But the copra industry soon suffered two major setbacks, the Great Depression in the 1930s (Stanley, 2004) and the drastic fall in world copra prices during the 1960s due to competition from edible oils such as soy. The expiry of land leases, low coconut yields due to senile stands, climatic disasters, poor international copra prices (Fiji National Agricultural Census, 2009), soil exhaustion (Bayliss-Smith et al., 1998), attacks by rhinoceros beetle (*Oryctes rhinoceros*) and high cost of transportation (Naicker, 2012) have emerged as major concerns for the coconut farmers of Fiji. There was a significant decline in the area under coconuts from 49,812 ha in 1991 to 17,757 ha in 2009. The average annual coconut oil export declined from 5133 t during 1991–1995 to 501 t during 2006–2010 (Naicker, 2012). Today most of the coconut plantations in Fiji are senile with 70% of the coconut palms over 100 years old, 6% over 50 years old and 24% over 30 years old (Government of Fiji Islands, 2013).

4.4. Commercial Taro plantations in 1990s

The taro export market in the Pacific was dominated by Samoa from 1980 to 1993, however, intensive monoculture with fewer rotations increased the susceptibility of taro to pests and diseases (Chan et al., 1998) resulting in the outbreak of the taro leaf blight (*Phytophthora colocasiae*) in 1993 (Brunt et al., 2001). In 1994 the market opened up for Fiji with a steady rise in the area under taro from 12,816 ha in 1991 to 15,194 ha in 2009 (Fiji National Agricultural Census, 2009). Since the main islands of Fiji were threatened by the taro beetle (*Papuana uniondis*), commercial taro production came up in Taveuni where there were no incidences of its occurrence. Today taro is the second largest export earner of Fiji with 70% of export taro coming from island of Taveuni (McGregor et al., 2011). Lin (2016) reported that Taveuni has the highest deforestation rate in Fiji due to the expansion of commercial taro farms. He observed increased focus on two hybrids the *Tausala ni Samoa* and *Samoa hybrid* at the expense of traditional varieties, agrodeforestation, intensive application of fertilizers and herbicides, declining soil fertility due to short fallows and non-adoption of crop rotation practices (McGregor et al., 2011), with recent taro exports being rejected on account of their inferior quality (Lin, 2016).

Table 4
Contribution of agriculture to GDP (FJD millions).
Source: Statistical News (2016).

GDP	2011	2012	2013	2014	2015(r)	2016(p)
Agriculture	472.61	465.25	497.08	500.43	541.80	500.79
Subsistence	152.50	153.25	154.50	153.91	153.27	149.10
Informal	37.71	37.89	38.20	38.06	37.90	36.87
General Government	8.24	7.73	8.72	10.05	11.26	9.86
Non-General Government	274.16	266.37	295.65	298.40	339.37	304.96
Fiji GDP	5738.84	5819.83	6095.35	6436.91	6684.37	6709.77
Agriculture as % of GDP	8.24	7.99	8.16	7.77	8.11	7.46

r - revised, p – provisional, GDP at current basic price, General Government category includes the central government, local government and statutory bodies, Non-General Government includes privately owned local establishments, branch and subsidiary of an overseas company and those government enterprises operating with an intention of making profit.

5. A neo-traditional approach to farming

5.1. Farming systems in Fiji

Three types of farming systems have emerged in Fiji, commercial, semi-commercial and subsistence. Subsistence farmers predominantly cultivate crops for household consumption, exchange and gifting and do not generally sell their produce. Subsistence farmers make up 33% of households and are engaged in the cultivation of traditional food crops for household consumption and livelihoods (DOA, 2013), although there is a growing preference for other food crops. Semi-commercial farmers raise crops for both domestic consumption and sale particularly in the local markets. Commercial farmers generally operate on large scales and are oriented towards cash crops such as taro, sugarcane and kava (Foraete, 2001). Over the years the share of agriculture in the country's GDP has more or less stagnated. Privately owned local or overseas establishments make the highest contribution to the agriculture GDP, followed by subsistence, informal and general government categories (Table 4).

The agriculture sector in Fiji is dominated by smallholders (Table 5) with about 43.90% farms less than one hectare in size, 38.70% between one to five hectares and only 0.20% farms greater than a hundred hectares (Fiji National Agricultural Census, 2009). An analysis of the farms by crop types (Table 6) indicates that among temporary crops, most of the farms cultivate commercial dalo and cassava which occupy the maximum planted area while traditional resilient food crops like *dalo ni tana*, *kumala*, *tivoli* and yams have been planted on much smaller scales. Among permanent crops there is an increasing focus on cash crops like kava whereas trees such as breadfruit and pandanus occupy very small areas. The over emphasis on export oriented crops has resulted in agrodeforestation and marginalisation of several resistant crops which are important for ensuring food and nutritional security.

5.2. The problem

As agriculture on small farms becomes commercialised, farmers start growing cash crops in favour of traditional crops and goals of food security are transformed into goals of increasing profits (Pingali and Rosegrant, 1995). In the villages of Fiji land previously used for multi-cropping traditional food gardens has been planted with cash crops (Foraete, 2001). The decline in production of traditional food is due to rural-urban migration, preference for raising less labour oriented crops (Thaman, 1988), and a paradigm shift from traditional to modern diets (Krause, 2011) of imported food commodities easily available in supermarkets.

Table 5
Classification of farms on the basis of size.
Source: Fiji National Agricultural Census (2009).

Size (ha)	Number of farms	Total area (ha)	Land use (ha)						
			Temporary crops	Permanent crops	Fallow up to 3 years	Coconut	Pasture	Forest	Non-agri land
< 1	28,564	11,819.62	4959.68	3054.23	2219.70	59.52	132.94	555.77	837.78
	(43.90)	(4.70)	(41.96)	(25.84)	(18.78)	(0.50)	(1.12)	(4.70)	(7.09)
1 - 5	25,113	60,598.86	11,468.64	25,461.67	10,728.00	570.37	2694.02	5982.75	3693.4
	(38.70)	(24.00)	(18.93)	(42.02)	(17.70)	(0.94)	(4.45)	(9.87)	(6.09)
5 - 20	9955	88,357.23	7503.26	36,746.62	15,581.00	1426.68	9655.36	11,159.10	6285.22
	(15.30)	(35.10)	(8.49)	(41.59)	(17.63)	(1.61)	(10.93)	(12.63)	(7.11)
20 -100	1275	50,515.77	1054.82	8171.06	4483.12	2431.96	17,391.92	13,177.60	3805.24
	(1.90)	(20.10)	(2.09)	(16.18)	(8.87)	(4.81)	(34.43)	(26.09)	(7.53)
> 100	126	40,567.34	252.04	4760.11	1191.51	2512.97	16619.23	13,770.10	1461.35
	(0.20)	(16.10)	(0.62)	(11.73)	(2.94)	(6.19)	(40.97)	(33.94)	(3.60)

Note: figures in parenthesis indicate percentage.

Table 6
Area, production and value of temporary and permanent crops.
Source: Fiji National Agricultural Census (2009).

Crop	Number of farms with the crop	Planted area (ha)	Total production (t)	Production sold (t)	Value (FJ$ million)
Temporary crops					
Cassava	38,757	15,447	58,771.61	32,899.42	21.01
Dalo	37,106	15,195	56,644.61	42,758.29	49.52
Dalo ni Tana	2981	365	612.78	258.31	0.21
Eggplant	3424	571	1692.98	959.40	0.72
Ginger	582	217	1945.54	1891.87	1.49
Kumala	3747	558	1270.64	662.53	0.54
Rice	2821	3624	4287.52	1195.03	0.89
Tivoli	572	61	121.68	99.83	0.26
Yams	6565	851	564.91	153.53	0.18
Permanent Crops					
Banana	4261	1087	3392.38	2911.70	2.58
Bele	768	88	251.24	111.94	0.03
Breadfruit	81	9	10.41	2.41	0.00
Copra	2755	15,009	10,634.20	8945.39	3.24
Pawpaw	465	220	334.77	307.81	0.35
Pineapple	914	445	2829.30	2348.97	1.87
Plantain	1684	242	618.93	250.65	0.40
Pandanus	765	108	250.79	103.47	0.52
Kava	21,306	8884	6066.83	4728.40	66.40

Most of the projects intended to enhance food security in Fiji have failed because they do not recognise the fact, that food systems need to be aligned with the traditions and culture of the Fijian people and the island way of life (Kumar, 2013). Harrison and Karim (2016) have reported that the farmers still use some of their traditional methods to address problems like soil erosion, droughts, floods, insect and pest attacks in their farms. The Fiji 2020 Agriculture Sector Policy Agenda (Ministry of Agriculture, 2014) advocates the transformation of agriculture from subsistence and semi-commercial to commercial farming. It marginalises the significance of indigenous knowledge and healthy and nutritious diets in food production systems. According to Davidova et al. (2013) traditional farmers are often under represented, excluded from agricultural policies and support schemes, with most of the governments focusing on those agrarian sectors which are strong revenue earners. Harrison and Karim (2016) expressed their concern over the lack of an institutional champion of agroforestry and even reforestation projects in the country predominantly focusing on single species plantations. With the islands so very rich in biodiversity, agroforestry systems need to be modelled on traditional tree species which can ensure food security, climatic resilience and sustainable livelihoods.

5.3. The way forward

There are two ways to achieve food security, one is to become self-sufficient in food and the other is to strengthen the food import sector (Sharma, 2006). Choosing the latter implies that Fiji boosts up the foreign exchange earnings through export, to import food commodities. This may not be a viable option considering the fact that food import is a covert form of food insecurity for a nation and its people. Choosing the former option would involve the adoption of neo-traditional agriculture (Sugam et al., 2016). A neo-traditional approach to farming would allow the integration of scientific and local indigenous knowledge for the improvement of farming systems and would be more adoptable by local communities. Keeping in view the conservatism of the island people and the institutional and policy constraints, Warner (2007) stated that traditional farming systems are complementary and efficacious to the island way of life. Land use models should be based on a mix of traditional and modern farming in such a way that they adopt and reflect the best management practices of both. It would therefore be a fallacy to totally uproot traditional farming systems and replace these with conventional agriculture. Thaman (1994), proposed a hybrid agroforestry approach which involves adapting existing agroforestry systems to changing demographic, social and cultural conditions. The biggest constraints pertaining to such a strategy are lack of government support to traditional farmers, low income of subsistence farms, less demand of traditional food and rural-urban migration.

5.3.1. Enhancing on farm diversity and security

Around 70% of the total cropped area in the Pacific is rain-fed (FAO, 2008b) and hence agriculture is sensitive to the vagaries of climate. Landrace conservation can help identify resistant varieties and prevent the erosion of local diversity. The abiotic stress adaptation capacity of landraces should be utilised in conventional breeding and crop improvement programs. The establishment of community seed banks which improve access to diverse locally adapted planting material is a neo-traditional approach that can allow farmers to produce, conserve and exchange valuable germplasm. Community seeds banks have three important functions: the conservation of genetic resources, improved access and availability of planting material and seed and food sovereignty (Vernooy et al., 2014). Resistant varieties can be disseminated in areas encountering problems of saltwater intrusion, groundwater salinization and frequent flooding. The cultivation of nutritious fruit and nut trees with food crops in polycultural systems is essential to improve

the efficacy of food production systems and ensure sustainable livelihoods. Such on farm conservation of biodiversity would reverse agrodeforestation and recognise communities as the custodians of local genetic diversity and indigenous knowledge (Jarvis et al., 2000). Since island states face problems of food shortage in the aftermath of natural disasters food security at the household level has to be enhanced. This can be achieved by encouraging farmers to reserve small plots in their farms for the cultivation of famine food such as wild yams, edible ferns, ivi and sago palm. Traditional food preservation practices have to be revived for short to medium term food security.

5.3.2. Promoting local food crops

It is equally important to enhance the viability of traditional food production systems. The government should promote local food and local cuisine through sensitisation drives which highlight the poor nutritional value of packaged food. The island of Pohnpei has a similar story with people drifting away from traditional food to imported processed food resulting in NCDs and micronutrient deficiencies.

A local non-government organization, the Island Food Community of Pohnpei initiated the “Go local” food campaign. Gene bank collections of traditional carotenoid rich cultivars of bananas, pandanus, breadfruit and taro were established along with community awareness programs. Food rich in provitamin A carotenoid protects against vitamin A deficiency, anaemia, diabetes and cardiovascular diseases (McLaren and Frigg, 2001). Traditional infant food like the deep orange flesh coloured karat banana that has 100 times the β-carotene present in the marketed cavendish variety but was replaced with processed baby food was reintroduced in the local markets. The movement resulted in a positive change in attitude with an increase in the consumption of local food (Englberger et al., 2013). The success of this campaign may serve as a guiding light to come up with similar programs which can preserve the genetic diversity of traditional food resources and ensure food security in island countries like Fiji.

The identification of certain traditional food crops which can be promoted as export commodities in the international market may also be the way forward. Fresh and frozen root crops have demand in Australia and New Zealand due to a sizeable Pacific population in these countries. In horticulture exotic fruit crops such as papaya, mango and pineapple are the exported commodities (USA International Business Publications, 2015). Untapped opportunities can be identified by promoting markets for traditional Fijian fruits and nuts such as tahitian chestnut, cutnut, tropical almond, tahitian vi apple, malay apple, oceanic lychee and soursop. A recent research by Walace et al. (2016) involved value-addition and development of processing facilities for domestic and export markets for nuts of *Canarium indicum* in Vanuatu and Solomon Islands. Similar initiatives will go a long way in diversifying Fiji’s export basket with local produce.

5.3.3. Organic farming

A promising neo-traditional alternative with the potential to enhance food and nutritional security in the developing world is organic farming. Fiji currently caters to limited exports of organic cold pressed coconut oil, noni juice, spices and ginger but there is a huge untapped potential to expand the organic market. The fact that organic foods are pricier than conventional food (Gottschalk and Leistner, 2013) could be a way to make these practices lucrative. Myths associated with organic farming have been refuted by Badgley et al. (2007) through the examination of the existing global dataset. This analysis revealed that in the developing world, yields from organic farming surpass yields from intensive conventional farming due to the incorporation of practices such as cover cropping, agroforestry, crop rotation, organic manures or efficient water management. Besides, leguminous cover crops produce enough nitrogen to replace nitrogenous fertilizers currently in use in temperate and tropical agroecosystems. Organic farming performs better than conventional agriculture during climatic extremes by improved water holding capacity due to high organic matter in times of drought and less runoff coupled with higher groundwater recharge during excessive rainfall (Lotter et al., 2003; Pimental et al., 2005). Since the restriction of modern food production systems to a few staples has exacerbated micronutrient deficiencies, cropping diversity on organic farms by introduction of traditional varieties can combat problems of hidden hunger (FAO, 2007). Such a neo-traditional approach to farming would certainly benefit countries like Fiji, which is highly vulnerable to climatic exigencies and grappling with problems of NCDs. Current policies need to be relooked at in order to include organic farming as a key strategy for holistic growth in the agriculture sector.

5.3.4. Synergies with the tourism sector

Migration of people from villages to towns could be curtailed by the development of synergies between farming systems and the flourishing tourism sector in the country, through farm to table and agritourism. The resorts of Fiji have been catering to international tourists with exotic menus but a culinary renaissance is slowly taking roots with some chefs blending traditional food with modern cuisine. Due to concerns pertaining to inconsistent supply and quality of the locally produced agriculture commodities, the tourism sector imports 80% of fruits and vegetables (Young and Vinning, 2007). These problems are severe due to the small size of landholdings. A neo-traditional approach to address this issue is clustering which refers to the agglomeration of enterprises sharing common interests. The Fijian sentiments of community bonding in traditional societies can be utilised to integrate clusters that can produce and market local products sustainably (Taulealea, 2010). This is of key importance to the hotel industry since clustering would be able to improve supply and quality of local fruits and vegetables more so with the newfound interest in traditional Fijian cuisine. Such neo-traditional approaches would add to the diversity of the tourism products that Fiji has to offer and ensure that local food and traditional practices are kept alive and passed on to future generations. Agroforestry practices should be revived for food security and diversification of farm income through Non-Timber Forest Products. This would boost supplies of nutritious food to the local markets and the establishment of small scale industries such as handicrafts, botanicals particularly for herbal medicine and cosmetics, apiculture, and fruit and nut processing which have potential markets in the tourism sector.

6. Conclusion

The challenging issues of land degradation, agrodeforestation and food security while sustaining domestic food production in Fiji can be addressed by propagating ideas that celebrate the cultural association between the land and its people. Given the small size of land holdings, predominance of rain fed agriculture, high vulnerability to climate change and international market fluctuations, it is imperative to adopt food production systems that bridge the gap between the traditional and the modern. Future research should concentrate on improving supplies of healthy and nutritious food to local markets through organic farming, and traditional agroforestry practices. Export diversification into Fijian fruit and nut species has to be explored through capacity building and value adding projects. The identification and utilisation of valuable landraces and local cultivars for crop improvement programs, community seed banks and enhancing resilience of agroecosystems also promises scope for potential research. Further there is a need to tap the exponential growth in tourism by strengthening linkages between farms and the tourism industry through future development of clustering methodologies in Fiji. Policy research should focus on creating an enabling and inclusive environment for neo-traditional approaches to address food security issues.

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